# THREE NEW SPECIES OF CHIRONOMIDAE (DIPTERA) FROM THE AUSTRALIAN WET TROPICS

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Two new genera and three new species of Chironomidae are described from Australia in all life history stages: in the subfamily Orthocladiinae: *Echinocladius* gen. nov., type species *E. martini* sp. nov.; in the Tanypodinae: *Australopelopia* gen. nov., type species *A. prionoptera* sp. nov. and in the Chironominae: *Polypedilum australotropicus* sp. nov. All species occur in streams of the Wet Tropics, where they are the subject of ongoing ecophysiological study. *E. martini* and *A. prionoptera* have a wide distribution in cool, shaded eastern submontane streams, inferred to reflect a Gondwanan-type distribution. In the case of *Echinocladius* this is supported by a postulated phylogenetic sister-group relationship to *Pirara* Boothroyd & Cranston, already known from Australia and New Zealand, and now with a third species decribed here, *Pirara edwardi* sp. nov., from Patagonian Argentina. The erection of a new genus of pentaneurine Tanypodinae, *Australopelopia*, also is justified by phylogenetic reasoning, with a sister group relationship to a more widely defined *Thienemannimyia*-group of genera postulated. *Polypedilum australotropicus* is differentiated from Australian congeners, with a new larval feature, a hyaline area postulated to be the clypeal section of the frontoclypeus, figured and discussed. ❐ *Chironomidae, Orthocladiinae, Tanypodinae, Chironominae, tropics, Australia, Argentina.*

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The Australian chironomid (Diptera: Chironomidae) fauna is well enough known on a continental scale (Cranston, 1996, 2000) to allow some understanding of ecological and biogeographic relationships. We can recognise taxa: i) related to those in other cool areas of the southern continents; ii) related to those in warmer gondwanan areas; or iii) non-gondwanan, including anthropogenic, elements derived more recently from the north. Assessing the correctness of previous taxonomic placements depends upon a global perspective, and increasingly upon the availability of all life history stages to allow appropriate phylogenetically-based ecological and biogeographic understanding. Still, however, detailed study of the biota of a poorly-studied part of the Australian continent reveals undescribed, unallocated or misallocated taxa, and the Wet Tropics of North Queensland is no exception (Cranston, 1999, 2000). Some of these chironomid taxa are the subject of evolutionary-based research, for example in ongoing studies of the eco-physiological responses of ecologically and biogeographically-contrasting lotic chironomid taxa (Brendan McKie, in prep.). Three of the taxa involved represent different subfamilies, biogeographic origins, functional feeding groups and physiological responses. This contribution provides formal names and descriptions for taxa for which codes have been used previously. Phylogenetic estimates made in support of decisions are based on on-going data matrix constructions available from the author on electronic request.

## METHODS

Specimens were collected from streams by individual larval collection, or from drift using a modified Surber sampler with mesh size of approximately 300μm, for an exposure period that minimally included the night hours (18.00-6.00h). Sorting was done in the field immediately after net recovery using a binocular microscope and natural light where possible. Individual larval rearings were made in native water, held at ambient temperature, in separate vials stoppered with cotton wool. Specimens were prepared with at least the genitalia of pharate adults dissected out and mounted in Euparal, or some whole larvae in Hoyer's mountant. Terminology follows Sæther (1980) except for use of taenia (taeniate) for broadened thin setae (Langton, 1994). Mensural features are counts, or lengths in μm unless stated. Localities are

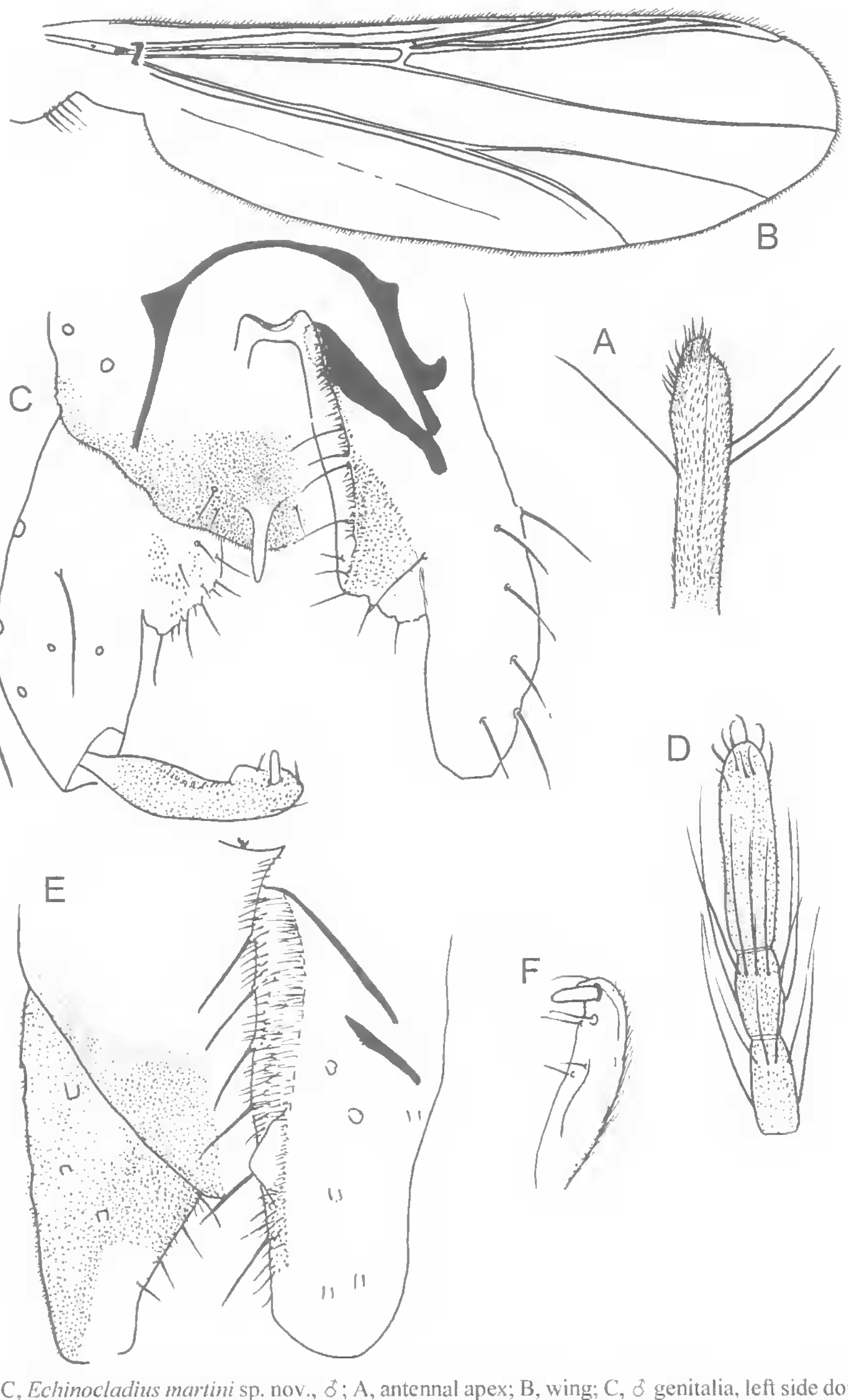


FIG. 1. A-C, *Echinocladius martini* sp. nov., ♂; A, antennal apex; B, wing; C, ♂ genitalia, left side dorsal, right side semi-internal. D-F, *Pirara edwardi* sp. nov., ♂; D, antennal apex; E, ♂ genitalia, left side dorsal, right side semi-internal; F, gonostylus, isolated, left, mesal.

arranged from N to S: either GPS-derived degrees, minutes and seconds (xx°xx'xx") or decimal minutes (xx.x') are cited. Elevations, where cited, are map-derived. Unless stated otherwise, the collector is the author, and specimens are deposited in the Australian National Insect Collection (ANIC), Canberra. Specimens are entered into the ANIC database. Abbreviations: AR, antennal ratio (terminal flagellomere [or 2 in Tanypodinae]: remainder of flagellum); L(e), larva (exuviae); LR, leg ratio (tarsomere1: tibia); NP, National Park; P(e), pupa (exuviae); SF, State Forest.

## SYSTEMATICS

## ORTHOCLADIINAE

### **Echinocladius** gen. nov. (Figs 1-4)

Orthocladiinae 'MO5' Cranston, 1996, 2000; McKie & Cranston, 1998.

TYPE SPECIES. *Echinocladius martini*, sp. nov.

ETYMOLOGY. *Echino*, Latin for thickly set with spines, as is the pupa, and *cladius*, Latin for a diminutive branch (clade).

DIAGNOSIS. Adult with kidney-shaped eye, thorax with well-developed antepronotum, lacking acrostichals, wing with $R_{2+3}$ compressed between $R_1$ and $R_{4+5}$, tarsi with pulvilli, hypopygium with short bare anal point, with inferior volsella. Pupa lacks frontal setae, has mutiplied dorsocentral setae, carries dense fine spines on tergites and sternites, and the short anal lobe has macrosetae comprising 3 stout short spines. Larva purple in life, having large dilate Lauterborn organs, a 6-segmented antenna, simple, broadly lanceolate S1 seta; pecten epipharyngis with 3 unfused rounded scales; mandible apical tooth shorter than combined width of 4 inner teeth; mentum with simple, broad median tooth with median nipple and 5 pairs of evenly decreasing lateral teeth.

DESCRIPTION. MALE. Small, length up to 2.1mm; wing length to 1.2mm. Antenna with 13 cylindrical flagellomeres, well-developed plume extending to apex lacking strong subapical seta (Fig. 1A); groove extending from flagellomere 4 to 13; sensilla chaetica on flagellomeres 2-5 and sub-apex of 13. AR c.0.5. Head with kidney-shaped bare eye without dorsomedial extension. Temporal setation restricted to few linear postorbitals. Tentorium tapering apically, strongly dilated in basal section, with distinct sieve plate, cibarial pump rectangular with short cornua. Clypeus densely setose. Palps with 5 segments, 2nd longer than subequal 3-4, 5th longer; 3rd without sensilla chaetica.

Thorax uniform medium brown. Antepronotum well developed, lobes not medially narrowed, narrowly in medial contact. Thoracic setation: 0-2 antepronotals, acrostichals absent, few dorsocentrals and prealars; few uniserial scutellars. Pleurae bare.

Wing (Fig. 1B) membrane with fine punctation, without macrotrichia. $R_1$ running close to $R_{4+5}$ with $R_{2+3}$ visible but compressed between, ending close to apex of $R_{4+5}$, above $M_{3+4}$; costa extended. Brachiolum with 1 seta, R with few setae, remaining veins without setae. Squama with few setae. Anal lobe moderately produced. FCu far distal to r-m, $Cu_1$ curved, with slightly recurved apex, strong to wing margin.

Legs with fore tibial spur shorter than tibial apex, median tibia with two short, subequal spurs; hind tibia with one long spur subequal to tibial apex, the other short; mid- and hind spurs weakly denticulate; comb disorganised; pseudospurs absent. Sensilla chaetica apparently absent. Pulvilli well developed, at least half claw length, claws apically slightly pectinate.

Abdomen with unicolorous tergites, with few, long, setae concentrated in anterior half of tergite; tergite IX with few apical setae. Anal point narrow, bare, placed posteriorly on tergite and projecting beyond apex of tergite. Sternapodeme an inverted U-shape, with weak to strong anterolateral projections; phallapodeme well developed. Hypopygium (Fig. 1C) lacking superior volsella; inferior volsella elongate-triangular, with rounded posterior lobe. Gonostylus simple, with megaseta and small crista dorsalis. Virga absent.

FEMALE. As for male, except body length 1.9-2.6mm, wing length 1.1-1.4mm. Antenna (Fig. 2A) with 5 flagellomeres; AR 0.44-0.64. Head with 2-3 outer vertical/postorbitals. Wing (Fig. 2B) with R, $R_{2+3}$ and $R_{4+5}$ darkened, closely appressed although veins distinct, with $R_{4+5}$ continuing distinctly into costal extension; R, $R_1$ and $R_{4+5}$ setose; venarum ratio 1.32-1.43; squama with 7-9 setae. Claws simple. Genitalia (Fig. 2C, D) with tergite IX small, weakly emarginate medially, with single row of posterior setae or some signs of aggregation into two clusters; gonocoxite IX weakly bulging, with many long and short setae; gonapophysis VIII divided, large ventrolateral lobe overlying posterior part of

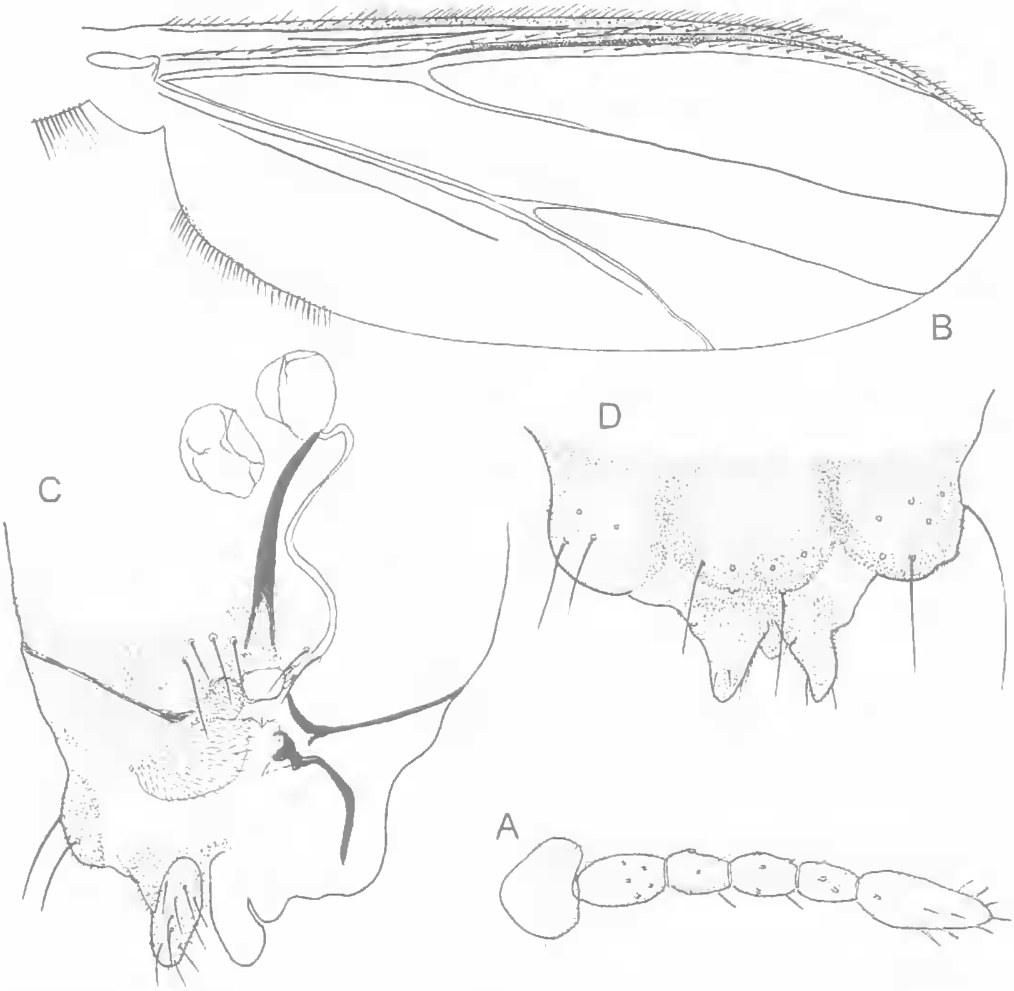


FIG. 2. *Echinocladius martini* sp. nov., ♀; A, antenna; B, wing; C, ♀ genitalia, ventral; D, ♀ genitalia, dorsal.

strong dorsomesal apodeme lobe dark, quite large, weakly curved to interrupted medially; notum moderately lengthed, extending no further anterior than posterior seminal capsules; 2 seminal capsules pale, ovoid to pear-shaped, without microtrichia, with well developed neck; spermathecal ducts curved with pronounced bulbs before separate openings; labia simple and weakly sclerotised. Tergite X and cerci small, postgenital plate triangular.

PUPA. Small, 3-4mm. Exuviae uniformly grey-brown. Cephalothorax: frontal setae absent but possibly represented by paired scars on frons. Frontal apotome smooth. Ocular field with one vertical and one postorbital seta. Thorax with 2 median and one lateral antepronotals, 3 subequal precorneals; with numerous thoracic setae not readily allocated to conventional groups (Fig. 3A). Thoracic horn absent. Dorsum of thorax variably rugulose. Prealar area rounded, with c. 10 setae. Wing sheath smooth.

Abdomen without pedes spurii A and B. Tergites (Fig. 3B,C): predominantly without shagreen (may be faint on II) II without hook row, II-VIII with posterior transverse spine band with some medial spines pale and very elongate, IX with median patch of long dark spines. Conjunctives II-IV with long translucent anteriorly-directed slender spines, often very dense, medially divided on IV. Sternites (Fig. 3C) with or without fine shagreen, when present, notable on posterior segments; II with cluster of long translucent spines medially. Conjunctives III-V with dense long translucent anteriorly directed fine spines. Anal lobe small, squared-off, with antero-median patch, of long and short spines, with 3 subequal short, stout macrosetae (Fig. 3D), much shorter than anal lobe. Male genital sac extends posteriorly beyond anal lobe; that of female much shorter. Setation: generally 5 D, 4 L and 6-8 V setae.

LARVA. Fourth-instar larva medium-sized, up to 5.8mm long. Dorsal surface of head with single frontoclypeal sclerite, partially fragmentary posteriorly, smooth anteriorly. Antenna (Fig. 4A) 6-segmented, with 3rd subequal to 2nd, 4th and 5th short, 6th minute. AR c 1. Ring organ at base of segment 1; antennal blade simple, extending to sub-apex. Lauterborn organs well developed, dilate, subequal in length to segment 3, style half length of 3rd segment. Labrum (Fig. 4B) with SI simple, broadly lanceolate, SII long, slender, SIII and IVa,b simple and short, one chaeta lanceolate, remainder simple; spinulae strong. Premandible with one apical and one small but broad inner tooth, with weak premandibular brush. Pecten epipharyngis of 3 unfused rounded scales, the median one apparently either serrate, or notched, or both. Ungula short and squat with few short and simple and pectinate chaetae. Mandible (Fig. 4D) with outer and inner margins smooth, apical tooth shorter than combined width of 4 inner teeth. Seta subdentalis present, more or less rounded. Seta interna with 2 simple branches. Mentum (Fig. 4C) with median tooth simple and broad with median nipple; 5 pairs of lateral teeth decreasing on even slope. Ventromental plate narrow, basally overlying bulbous to ledge-shaped projection ventral to outermost mental teeth and extending nearly to outermost mental tooth (extent depends on degree of compression); beard absent. Maxilla (Fig. 4E) with squat palpiger, few galear lamellae, without pecten galearis, with one large triangular lacinial chaeta. Body with no evidence of lateral setae. Anterior parapods separate, with crown of elongate, simple, spines and small pectinate claws. Posterior parapods separate, with apical group of simple claws. Procercus as wide as high, dark pigmented posteriorly bearing 3 (perhaps 4) shortish anal setae. Anal tubules scarcely developed.

DISTRIBUTION. Monotypic, Australian/Tasmanian endemic, distributed along the eastern sub-coastal continental margin from 17°S to 42°S.

REMARKS. In Freeman (1961), males of *Echinocladius* key to *Kiefferophyes* Freeman based on the bare eye, outer tibial spur short relative to inner, non-macrotrichiose, finely punctate wing membrane, fringed squama and wing vein $R_{2+3}$ distinct though ending close to apex of $R_{4+5}$. Comparison with *Kiefferophyes* shows there is a superficial resemblance, but the genitalia differ especially in significant features in *Echinocladius* such as the lack of a strong virga, lack of any indication of a gonostylar extension and presence of simple, bare anal point. Freeman's (1961) coverage of the Australian Orthocladiinae is incomplete, and several taxa of 'small, black midges' are excluded. In the key to Holarctic adult Orthocladiinae (Wiederholm, 1989) *Echinocladius* belongs to a group with bare wings and eyes, fringed squama, small pulvilli and lacking acrostichals, amongst which it keys to *Psilometriocnemus* Sæther (at least to the species *triannulatus* Sæther) if the anal point is considered parallel-sided, or *Tvetenia* Kieffer if it is considered to taper.

The female of *Echinocladius* keys readily to *Parorthocladius* in Sæther (1977) who suggests that *Kiefferophyes* might run to this couplet. Although the female genitalia of *Kiefferophyes* remains undescribed, Sæther's deduction undoubtedly was correct, as was his speculation that the female genitalia might appear 'more similar to *Limnophyes*'. The resemblance of *Echinocladius* to *Kiefferophyes*, whose immature stages remain unknown and are therefore likely to be terrestrial, is discussed above.

Pupae of *Echinocladius* lack frontal setae and thoracic horns and always have many prealars and multiple thoracic setae. have dense abdominal armament including long needle-like or triangular spines on posterior of most tergites including IX, sternal conjunctives III-V with elongate pale needle-like spines, fine L-setae, and anal lobe rounded/truncated with 3 short macrosetae and without fringe. *Echinocladius* pupae key in Wiederholm (1986) to *Limnophyes* Eaton or *Paralimnophyes* Brundin, based on the distinctive presence of very elongate ('needle-like') spines on the tergites. However, this feature actually has a wider distribution amongst exuviae of presumptive Gondwanan orthoclad taxa, including *Botryocladius* Cranston & Edward, 1999, *Pirara* Boothroyd & Cranston, 1995 and some Australian taxa known thus far by codes,

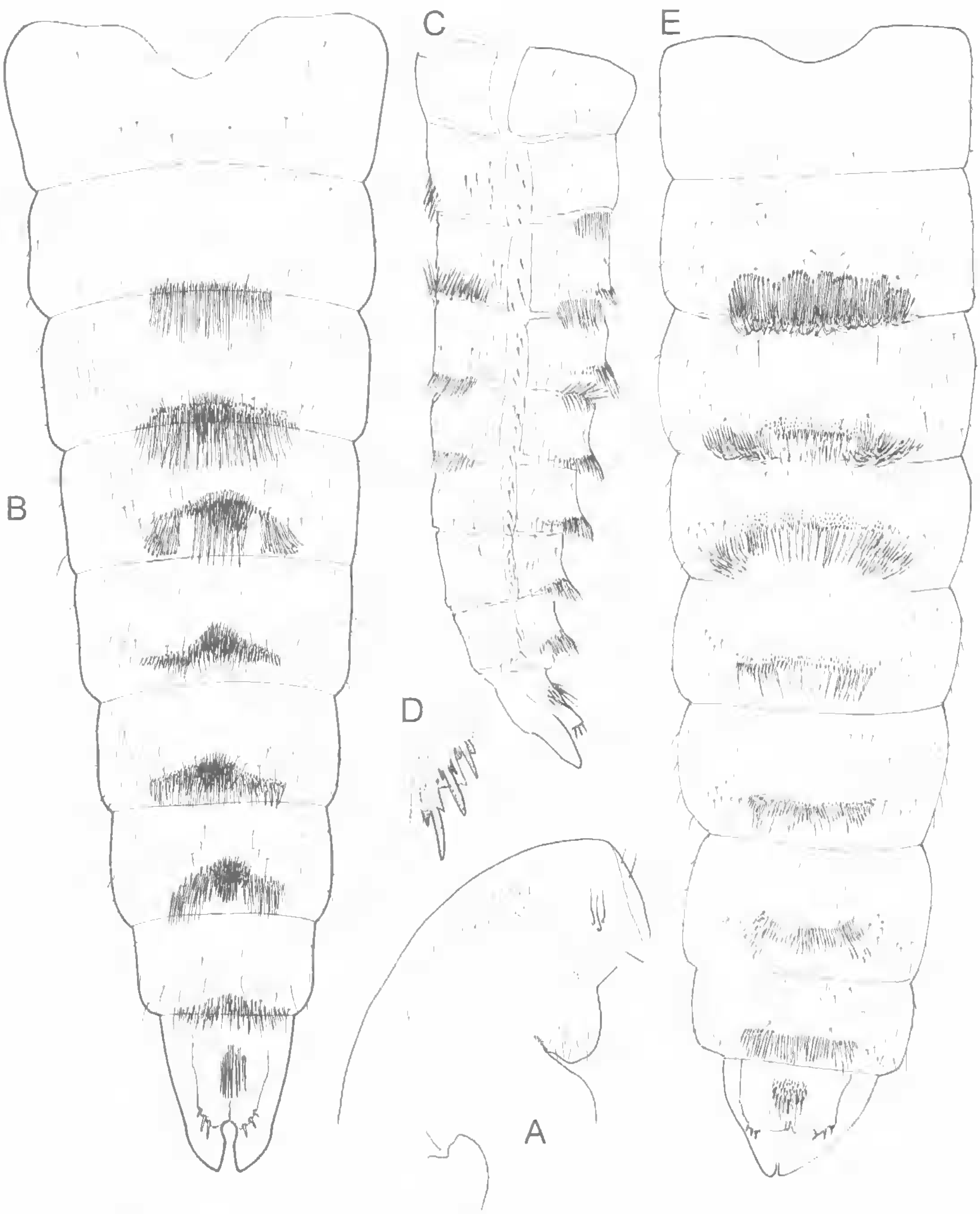


FIG. 3. A-D, *Echinocladius martini* sp. nov., pupa; A, thorax lateral; B, tergites, dorsal; C, abdomen, lateral; D, anal lobe setae. E, *Pirara edwardi* sp. nov., tergites, dorsal.

namely 'SO2' and 'SO3' (Cranston, 1996). That *Echinocladius* is neither a *Limnophyes* nor a *Paralimnophyes* can be inferred on pupal features from the very short and spine-like anal lobe macrosetae (in contrast to the conventional anal lobe setal length), the distinctive distribution of the needle-like setae especially on tergite IX and sternites, and the multiplicity of thoracic setae. These features, and lack of a thoracic horn eliminates both *Botryocladius* and 'SO2' from consideration. The taxon 'SO3' has conventional thoracic setation, lacks a thoracic horn, and has less developed tergal spines: the most similar pupal taxon is *Pirara* which shares much similarity of armament, differing predominantly in possessing frontal setae and in the conventional thoracic setation.

*Echinocladius* larvae have a 6-segmented antenna of moderate-length with exceptionally dilate Lauterborn organs that equal the length of the 3rd segment, itself subequal to the 2nd segment; S1 seta simple, as are all other S setae, labral lamellae absent, premandible simple and without beard, mentum with domed single median tooth; ventromental plate bulging but not extending beyond outer margin of mentum without setae beneath; mandible with 4 distinct inner teeth, smooth outer and inner surface and mola, with slender, 2-3 branched seta interna. In Wiederholm (1983) the larva fails to key due to an apparent irreconcilable character conflict, in that all included taxa with a simple S1 seta apparently have reduced procerci. In reality this is misleading since *Tokunagaia* does possess this combination of features (as does *Echinocladius*) but is incorrectly keyed: nevertheless *Tokunagaia* probably is not a close relative since the antenna, mentum and ventromental plate differ markedly. The ventromental plate shape of *Echinocladius* is reminiscent of *Limnophyes* and *Paralimnophyes*.

In providing an estimate of phylogenetic relationships for *Botryocladius*, Cranston & Edward (1999, table 6) scored a morphological matrix for putative relatives including *Echinocladius* (as 'MO5') but without *Pirara*. Parsimonious analysis of that matrix with the addition of *Pirara* suggests that this genus forms the sister taxon to *Echinocladius*, and this pair are sister to *Paralimnophyes* either alone or with *Synorthocladius* (see Cranston & Edward, 1999, fig. 11 for tree without *Pirara*). Revisiting *Pirara* showed that *P. australiensis* Boothroyd & Cranston actually does have a short, hyaline anal point, in contrast to the original description, figure and key (Boothroyd & Cranston, 1995). Furthermore, amongst Patagonian (South American) lotic drift net material there occurs pharate material belonging to this clade, and since this aids in generic delimitation and confirms a cool temperate biogeographic scenario (Boothroyd & Cranston, 1995), the species is described briefly as *Pirara edwardi* sp. nov. in this contribution.

## **Echinocladius martini** sp. nov.
(Figs 1-4)

ETYMOLOGY. The specific epithet honours Australian colleague Jon Martin, who first associated the pupa and adult of this taxon by rearing.

MATERIAL. HOLOTYPE. Le/Pe/♂, Australia, 35°22'S 148°50'E, ACT, Blundell's Ck, ix.1999, ex-wood surface, reared Cranston, in ANIC. PARATYPES. Queensland: P♂, 3Pe, 17°01'S 145°35'E, nr Mareeba, Davies Ck above falls, 520m, 11/12.iv.1997, 6Pe, 19/20.vi.1997, 7Pe, 27/28.viii.1997, 4Pe, 17/18.xii.1997; 14Pe, 17°08'06"S 145°35'35"E, Danbulla, Kauri Ck, 17/18.xii.1997; P♀, Pe, 17°20'S 145°28'E, Herberton, Carrington Falls Ck, 800m, 9/10.iv.1997; L, 6Pe, 17°26'48"S 145°28'28"E, Nigger Ck, 1100m, 19.xii.1997; 2Pe, 18°11.7'S 145°46.0'E, Yuccabine Ck, 10.vi.1997 (McKie); 4Pe, 18°58.0'S 146°09.8'E, Camp Ck, 12/13.vi.1998 (McKie); 2Pe, 18°58.7'S 146°09.8'E, Mary Ck, 9.ix.1997 (McKie); Le/Pe/♂, P♂, 18°58'S 146°09'E, Paluma, Birthday Ck, 1000m, 24.x.1998 (McKie), 26Pe, 18°59'S 146°09'E, 25/26.iii.1998; 2Pe, 19°01'S 146°13'E, unnamed Ck S Paluma, 850m, 25/26.iii.1998; Pe, Eungella NP, Mt Dalrymple track, Cattle Ck, 950m, 22.iii.1998; 4Pe, 26°03'00"S 153°04'29"E, Coloola NP, Frankis Gulch, 6.iv.1996. NSW: 2Pe, 30°16'S 152°50'E, nr Dorrigo, Eve Ck, 9.x.1996; Pe, 31°54'S 151°34'E, Barrington Tops, Dilgry R.,14.iv.1990; 2Pe, 34°40'S 150°44'E, Barren Grounds N.R., Redback Stream, 9.iv.1994; 8Pe, 35°16'S 150°03'E, Morton NP, Wog Wog Ck, 25.iv.1994; Pe, 35°24'S 149°57'E, Mongarlowe R., 7.iii.1992, Le/Pe/♂, 15.iii.1992, 3Pe, 17.iii.1992; Pe, 35°23'S 149°55'E, Monga SF, Mongarlowe R., 2.ii.1991; Le/Pe/♀, 35°26'S 150°12'E, Bimberamala Ck, 28.ix.1996; Le/Pe/♂, Le/Pe/♀, 35°31'S 150°03'E, Clyde SF, Carter Ck, .x.1996; 2L, 6Pe, 35°34'S 150°02'E, Currowan SF, Cabbage Tree Ck, 30.iii.1994; Pe, 35°33'S 149°58'E, Clyde Mt., Sugarloaf Ck, 20.xii.1987, Pe/♂, Pe, 10.i.1988; Le/Pe/♀, 35°35'S 150°05'E, Paddy's R., 16.x.1993; PG, 35°35'S 149°28'E, Captains Flat. Molonglo R., 30.i.1988 (Atkins); Pe, 35°45'S 149°57'E, SE Araluen, Deua R., 19.xii.1990; Pe, 37°16'S 149°40'E, Mt Imlay, Imlay Ck, 13.i.1994. ACT: Brindabellas, PG, 35°20'S 148°56'E, Pierce's Ck, 23.i.1996, ex-wood (McKie); Le/P, PE, 35°22'S 148°50'E, Pe, Blundell's Ck, 26.iii.1988, 2Pe, 8/9.iv.1988, Le/Pe/♀, 13-16.iv.1988, Pe, 3.viii.1998, Pe, 24.i.1998 (Willis); Pe, 35°20'S 148°56'E, Lees Ck, 21.v.1998, Pe, 12/13.i.1998 (Willis & Cranston), Pe, 24.i.1998 (Willis), Pe, 16/17.vi.1998; Le/P♂, 2Le/Pe/♀, 35°25'S 148°47'30"E, Moonlight Hollow, 20.x.1991; Pe, 35°27'S 148°57'°, Tidbinbilla Ck, 19.ii.1989; Pe, 35°39'S 148°598'E, Namadgi NP, Orroral R., 21.ii.1988; L(P), 35°41'S 149°00'E, Gudgenby R., 14.ii.1988. VIC: Pe, 36°33'S 147°23'E, Mitta Mitta, Snowy Ck, 10.ix.1990 (Cook); Pe, 37°14.5S 148°45.5'E, East Gippsland, jct Bonang Hwy/gap Rd, Bonang R., 15.ii.1992; Pe/♂, 37°28'S 145°45'E, Steavenson R., 7.iv.1993 (Downes). TAS: Pe/♂, Lake St Clair, at entrance of Narcissus R., 9.x.1972

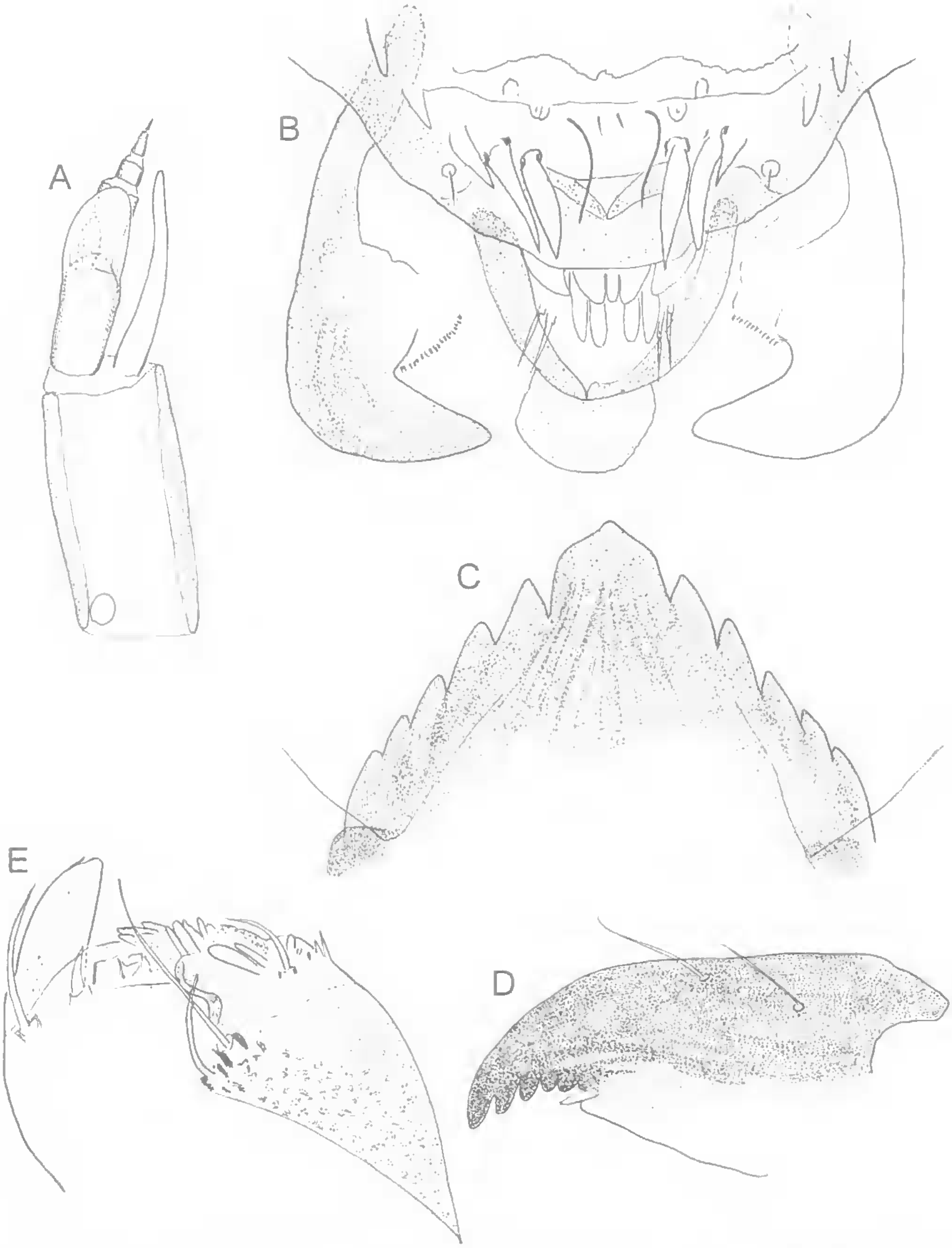


FIG. 4. *Echinocladius martini* sp. nov., larva; A, antenna; B, labrum; C, mentum; D, mandible; E, maxilla.

(Martin); L, Pe, 42°38.5'S 146°34'E, Mt Field NP, Twilight Tarn, 1000m, 7.ii.1992; 2Pe, 42°40.5'S 146°37.5'E, Lake Fenton, 1006m, 6.ii.1992; 2Pe, 42°40'S 146°35'E, Lake Seal, 900m, 7.ii.1992; 2Pe, 42°40.5'S 146°37.5'E, Lake Newdegate, 1140m, 6.ii.1992.

DESCRIPTION. MALE. (n=3) Thorax, legs and abdomen brown-black. Body length 1.6-2.1mm, wing length 1.0-1.3mm. Antennal segments 1-12: 375-430, 13: 215-320, AR 0.55-0.76. Head with 2 strong outer verticals and 1 postorbital, 10-13 clypeals. Palp 2-5, 20-30, 45-65, 60-80, 100-130. Thoracic setation: 1 lateral antepronotal; 0 acrostichals; 6-10 dorsocentrals, 3-4 prealars: 0 supraalars; 3-8 biserial scutellars. Wing setation: Sq 7-10, R 1-4; V.R. 1.32-1.43. $LR_1$ 0.54-0.57, $LR_2$ 0.39-0.44, $LR_3$ 0.48-0.51. Hypopygium, as in Fig. 1C, gonocoxite 80-160, gonostylus 55-101.

FEMALE. (n=2) Body length 1.6-1.9mm, wing length 1.2-1.4mm. Antennal segments 45, 28, 35, 32, 60; AR 0.42-0.56. Head setation: 0 frontal, 2-3 strong postorbitals, 15 clypeals. Thoracic setation: 0-1 lateral antepronotal; 0 acrostichals; 7-9 dorsocentrals, 3 prealars: 0 supraalars; 7-8 biserial scutellars. Wing setation: Sq 6-9, R 6-8, $R_1$ 6-8, $R_{4+5}$ 18-20; V.R. 1.5. $LR_1$ 0.59, $LR_2$ 0.39-0.42, $LR_3$ 0.46-0.49. Seminal capsules 60 × 56, ovoid, with short neck.

PUPA. (n=10) Length 2.2-2.9mm, cephalothorax 800-820mm. Frons without frontal setae. Thorax as Fig. 3A, abdomen as in Fig. 3B,C. Anal macrosetae 20-25 long (Fig. 3D).

LARVA. (n=10) Length 3.2-3.5mm, thoracic segments green, abdomen pale blue anteriorly tending to violet posteriorly. Head capsule length 260-315, pale, with occipital margin slightly darker, lateral mental teeth and inner mandibular teeth golden brown. Antennal segment lengths: 27-42, 9-12, 9-12, 3-4, 3-4, 2; AR 1.06-1.45. Blade 20-30, style 8-10, Lauterborn organ 9-11. Mentum width 49-75, median tooth 9-10. Mandible 77-107. Procercus 17-22 × 12-14, bearing 4 anal setae of maximum length 130-145.

DISTRIBUTION, ECOLOGY AND BIOGEOGRAPHY. *Echinocladius martini* is quite abundant in flowing waters, predominantly where shaded from elevated temperatures, from north Queensland, to southeast Australia and Tasmania, especially at middle to high elevations. In southeast Australian subalpine streams larval *E. martini* (as 'MO5') were amongst the most abundant chironomids living as gatherers on immersed wood in streams with riparian native vegetation, with abundances little reduced in streams with riparian pine plantation, but almost absent from otherwise comparable unshaded grassland streams (McKie & Cranston, 1998). In Birthday Creek at 1000m above sea level in the southern Wet Tropics, *E. martini* larvae are abundant at the water/surface interface, where they form translucent silken tubes, which are also used for pupation (B. McKie pers. comm.).

As with several other cool stenothermic Orthocladiinae, this predominantly lotic species occurs in standing waters at high elevations in Tasmania, where lower temperatures and aerating effects of wave action probably ensure favourable conditions.

As assessed by interception of floating pupal exuviae, *E. martini* adults emerged only in late summer/early autumn in a southeastern subalpine stream (Willis, 1998). Dates from serendipitous 24 hr drift net collections suggest that this seasonality is widespread in temperate areas, whereas in tropical Queensland exuvial collections supplemented with observations by McKie suggest essentially continuous emergence.

The evident sister group relationship to *Pirara*, and relationship to *Paralimnophyes*, *Botryocladius* and 'SO2' and 'SO3', a clade with strong gondwanan connections, suggests that *Echinocladius* also belongs in this biogeographic grouping. Not only does the phylogeny suggest this historical relationship, but the modern day distribution and ecology of the clade also carries the same inference. Taxa with phylogenetic relationships to New Zealand and Patagonian South America, as with *Echinocladius*, all share the same cool stenothermic physiology, and distribution along the eastern coast of Australia in shaded (and therefore cool and well oxygenated) streams. The same applies to *Australopelopia* (see below).

**Pirara edwardi** sp. nov.
(Figs 1D-F, 3E)

ETYMOLOGY. For D.H.D. (Don) Edward, recently retired chironomidologist of Western Australia, accompanist of the author to Patagonia in 1997, in acknowledgment of his companionship in field and laboratory.

MATERIAL. HOLOTYPE. P♂, Argentina: 16km S San Martin, Arroyo Partida, 21.i.1997, P.S. Cranston, in Museo de la Plata, Argentina. Holotype and paratypes, P♂, P♀, same locality, both mounted on one slide.

DESCRIPTION. MALE. (n=2, pharate) Thorax, legs and abdomen brown-black. Mensural features. Body about 2mm, wing length unmeasurable. Antenna (Fig. 1D) with segments 1-12: 445-450, 13: 77-82, AR 0.17-0.18. Head setation: 0 frontal, 3 strong postorbitals, 6-8 clypeals. Thoracic setation: 0-1 lateral antepronotal; 0 acrostichals; 5-6 dorsocentrals, 3 prealars: 0 supraalars; 4-5 biserial scutellars. Wing setation: Sq 8, remainder unmeasurable. LR uncalculable. Hypopygium (Fig. 1E) with densely microtrichiose tergite IX, with only 2 modest setae, apparently without anal point (although if short and hyaline, the anal point may be present and hidden in a crease in tergite IX of the teneral specimens, as with *P. australiensis*, above).

Gonocoxite 125-132 with no indication of superior volsella, inferior volsella with hyaline rounded-triangular apex, gonostylus (Fig. 1F) 50-53, without crista dorsalis. Virga weakly indicated, phallapodeme short, sternapodeme very thin. Gonocoxite dorsally with 6 long setae aligned along median border, overlapping with those of the opposite gonocoxite.

FEMALE. undescribable from early pharate pupa.

PUPA. (n=3) About 2mm long, essentally indistinguishable from the two described species of *Pirara* from Australia and New Zealand, and separable from *Echinocladius* by the 4 dorsocentral setae, and sparser tergal spinosity, including the presence of a broad gap in the median area of tergite III (Fig. 3E).

LARVA. Unknown, but predicted by its congenericity in other stages, to possess the autapomorphies of *Pirara*, notable the plumose submental, external mandibular and maxillary setae.

REMARKS. From re-examination of the described species of *Pirara*, and the material of *P. edwardi* above, the following features distinguish between the two genera:

The adult male of *Echinocladius* has well developed pulvilli, whereas *Pirara* has no trace; the wing of *Echinocladius* has $R_{2+3}$ distinct between $R_1$ and $R_{4+5}$ although they are approximated for all their length, obviously so in the female wing, whereas, although $R_1$ and $R_{4+5}$ are well separated in *Pirara*, $R_{2+3}$ is indistinguishable; *Echinocladius* has no virga, but a weak to moderately-developed virga is seen in *Pirara*; the claws of *Pirara* are toothed apically, at least *P. australiensis*, simple in *Echinocladius*.

In the pupa, *Echinocladius* lacks frontal setae, but they are fine and small in *Pirara*; the dorsocentral setae are highly duplicated in *Echinocladius*, with the conventional number and placement in *Pirara*.

In the larva, although the large Lauterborn organ is shared, the antenna of *Pirara* is 5-segmented and short, but 6-segmented and of more normal length in *Echinocladius*; the median mentum comprises a domed tooth in *Echinocladius*, double in *Pirara*; the mandible of *Echinocladius* has 3 inner teeth, compared to the 4 of *Pirara*; *Echinocladius* lacks the prominent plumose cephalic setae of *Pirara*, and labral S1 seta is simple in *Echinocladius* but bifid in *Pirara*.

## TANYPODINAE

### **Australopelopia** gen. nov.
(Figs 5-6)

*Pentaneura* sp. Cranston 1996, 2000.

TYPE SPECIES. *Australopelopia prionoptera* sp. nov.

ETYMOLOGY. Australo, for the so-far endemic distribution in Australia, and pelopia, a frequently used suffix in Tanypodinae, based on the suppressed Meigen 1800 genus name *Pelopia*.

DIAGNOSIS. Adult with thoracic tubercle, scape and pedicel setose, costa spinose in G, extending beyond apex of $R_{4+5}$ to near wing apex; $R_{2+3}$, $R_2$ and $R_3$ present; tibial spurs 1, 2, 2, elongate with several side teeth; hypopygium with evidence of volsella on median base of gonocoxite. Pupa with dilate tubular thoracic horn, with horn sac filling half lumen, with subapical connection to large ovoid plastron plate, filling much of corona; thoracic comb present; tergal scar present; shagreen of simple spinules, some aligned in rows; L(ateral) setae taeniate on VII and VIII, anal lobe outer marrgin spinose, inner bare, setae adhesive. Larva without swim hairs on body, head index c. 0.7; ligula 5-toothed with concave tooth row and inner teeth curved outward; 2nd antennal segment annulate, AR <4; Mandible with long seta subdentalis arising in indentation between projecting inner and basal teeth; SSm, V9 and V10 aligned at 45° to antero-ventral axis, with VP posterior to V10, dorsal pit present, S7 close to S8.

DISTRIBUTION. Monotypic, Australian/Tasmanian endemic, distributed along the eastern margin, from 17°S to 41°S, and in extreme southwestern Western Australia.

REMARKS. All stages of *Australopelopia* conform to diagnoses of the tribe Pentaneurini, but each differs in generic identity according to respective stage keyed. The key to larval Pentaneurini of the Holarctic region in Wiederholm (1983) is subjective in some features (e.g. 'low' vs 'medium-sized' mandibular basal teeth, 'weakly' vs 'strongly' concave ligula) leading to some ambiguity in interpretation. For example, *Australopelopia* runs to couplet 26 in which the only mutually exclusive feature requires assessment of the relative size — 'large' vs 'without large' — of the basal mandibular tooth. There is even uncertainty about whether the structure in question is indeed a basal tooth, or just an extension of the mola around the site of insertion of the seta interna. However, accepting that the basal tooth is large, then the outwardly curved inner teeth of the ligula and simple parapod claws lead to *Pentaneura* Philippi or *Telopelopia* Roback. It resembles the latter more in having shorter anal tubules and procerci, non-linear, coarsely granulate pseudoradula, but differing in the shape of the muscle attachment area. Alternatively, if it is considered to be without a large basal mandibular tooth, then subsequently an irreconcilable combination of features is encountered — although the ring organ of the palp lies in the middle third (admittedly at the anterior end), the pseudoradula does not link to any sclerotised area, and the pecten hypopharyngis teeth are homogeneous in size, precluding identity with *Trissopelopia* or *Hudsonimyia*. The alternative couplet would lead to some *Thienemannimyia*-series genera, none of which have as strongly developed inner/basal mandibular teeth as the taxon under consideration.

The aforementioned key does not take into account the taxonomically valuable feature of the relative positions of the cephalic setae and sensory pores whose intra-generic invariance and inter-generic diagnostic value was recognised by Kowalyk (1985). Notable amongst these are the ventral cephalic setae S9, S10, Seta submenti (SSm) and the ventral pit (VP) which alone can distinguish amongst Australian taxa of Pentaneurini (Cranston, 1996). Following Kowalyk's key for Pentaneurini possessing simple basal palp segment and concave ligula (couplet 14 onward), the approximation of S7 and S8, and presence of a dorsal pit leads to *Telopelopia* and the *Thienemannimyia*-series. The alignment of S10, antero-lateral to S9, essentially precludes *Pentaneura* from consideration (*Pentaneura* sp., Kowalyk 1985, figs 140, 141; *Pentaneura inconspicua*, *P.* ? *cinerea* Cranston pers. obs.).

The pupa, lacking stellate or indeed any branched spinules in the abdominal shagreen, keys in Wiederholm (1986) beyond the *Thienemannimyia*-series. The possession of adhesive anal lobe setae and a thoracic comb directs towards *Trissopelopia* Kieffer or *Paramerina* Fittkau, but matches neither precisely. Major problems concern reconciling the shagreen pattern (of *Trissopelopia* type), with the spinosity of the anal lobe (of *Paramerina*-type).

The male adult keys in Wiederholm (1989) beyond the *Thienemannimyia*-series if the hypopygium is considered to lack a volsella, and to *Telmatopelopia* Fittkau if the costa ending is considered close to above $M_{1+2}$. The female keys in Sæther (1977) to *Conchapelopia* based on the microtrichiose labia and curved coxosternapodeme, but lacks the setae on gonotergite IX. If the coxosternapodeme is considered straight, then *Thienemannimyia* and perhaps other related genera enter consideration.

From the above it appears that each life history stage keys to a different grouping, although there is a recurring link to the *Thienemannimyia*-series of genera, comprising some 8 poorly-differentiated, generic-ranked taxa. The keys did not purport to follow phylogenetic lines, and indeed the only suggestions of Tanypodinae phylogeny are some tentative remarks by Sæther (1977), and thus the only answer to this dilemma is to attempt a phylogeny of the relevant groupings. Thus a matrix of 32 characters scored for 23 taxa has been compiled and analysed under parsimony. Character selection includes all phylogenetically informative characters noted in the section above, plus those cited by Murray (1995) in consideration of placement of a somewhat anomalous *Conchapelopia* species, together with some from female genitalia (Sæther, 1977) and some from Kowalyk's (1984) study of head capsule setation and pits. This ongoing study, which is preliminary and is not presented in detail here, consistently supports the broadest recognised *Thienemannimyia* group (Sæther, 1977), with a sister group relationship to *Ablabesmyia*. Perhaps not unexpectedly given the discussion above, it is proposed that *Australopelopia* is sister to the *Thienemannimyia* group, a placement that is independent of outgroup used: namely either or all of *Coelopelopia* (Coelopynini), *Natarsia* (Natarsini) or *Apsectrotanypus* (Macropelopini). The previous identification of this taxon as a species of *Pentaneura* (Cranston, 1996) is rejected on this evidence. The proposed phylogeny suggests that the weak expanded area medio-basally on the gonocoxite might be considered to be a precursor of the well developed volsellae that essentially defines the enlarged *Thienemannimyia*-clade, that is, including *Telopelopia*, and with *Ablabesmyia* as sister to this group.

The following description includes features of taxonomic significance at generic level. Until further species are collected, the species description of *Australopelopia prionoptera* summarises features of the new monotypic genus.

**Australopelopia prionoptera** sp. nov.
(Figs 5,6)

ETYMOLOGY. *Prion*, Greek for saw, and *pteron*, Greek for wing, in reference to the saw-toothed anterior wing margin of the adult male.

MATERIAL. HOLOTYPE. Le/Pe/♂, 18°58'S 146°09'E, Queensland: Paluma, Birthday Ck, 24.x.1998, reared McKie, in ANIC. Holotype, and paratypes as follows: Queensland: 2Pe, 16°02.7"S 145°27.0'E, Daintree, Emmagen Ck, 9/10.ix.1997 (McKie); Pe, 16°05.08"S 145°27.36'E, Mason Ck, 23.iv.1999; P♂, 16°28'S 145°19'E, Mossman, 1st unnamed Ck nr Rex Ck, 5/6.iv.1997, L, Pe, 17/18.xii.1997, 5L, 19/20.x.1998 (Cranston & Dimitriadis), 8Pe, P♂, P♀, 2nd unnamed Ck nr Rex Ck, 5/6.iv.1997; 2L, 3Pe, 16°34'S 145°20'E, Mt Lewis, Churchill Ck, 6/7.iv.1997; 2P♂, 16°35.2'S 145°17.5'E, Mary Ck, 8.ix.1997; 6Pe, 16°56.2'S 145°37.0'E, Shoteel Ck., 9/10.ix.1997 (McKie), 3Pe, 17.iv.1999; 2Pe, 16°59'S 145°38'E, Clohesy R., 7/8.1997 (McKie); Pe, 17°01'S 145°35'E, nr Mareeba, Davies Ck above falls, 11/12.iv.1997, 2Pe, 19/20.vi.1997, 4Pe, P♀, 17/18.xii.1997; 3Pe, 17°06.3'S 145°35.9'E, Danbulla, Kauri Ck, 11.vi.1997; L, Le/P, P♂, P♀, 17°06'24"S 145°36'52"E, Mt Haig, ?U. Emerald Ck, 17/18.xii.1997; Pe,17°16'S 146°55'E, Junction Ck, 1-4.iv.1997; 5L, 6Pe, Pe/♂, 17°26'48"S 145°28'28"E, Nigger Ck, 19.xii.1997; 4Pe, P♀,17°35'S 146°42'E, Palmerston NP, Learmouth Ck, 8/9.iv.1997; L, 17°37'S 145°45'E, Palmerston NP, Tchooratippa Ck, 8-9.iv.1997; Pe, 18°11.7'S 145°46.0'E, Yuccabine Ck, 9.vi.1997 (McKie); Pe, 18°20'S 146°03"E, Cardwell, 5-mile Ck, 1-4.iv.1997; Le/Pe/♀, Pe/♀, 18°58'S 146°09'E, Paluma, Birthday Ck, 24.x.1998 (McKie); Pe, 20°02'S 148°35', Eugella NP, Mt Dalrymple trail, ? Cattle Ck, 950m, 22.iii.1998; 1L, 6Pe, 20°21'20"S 148°43'15"E, nr Proserpine, Brandy Ck, 21-23.iii.1998; Pe, 25°03'S 153°03'E, Fraser I., Boomanjin L., 23/4.ix.1989; Le/Pe/♀, 27°06'S 152°27'E, Atkinson's Dam, 24/5.vii.1991 (Cook, Cranston & Hillman); 4L, L(P), 27°45'S 150°14'E, Tamborine Mt., Sandy Ck, 26.ix.1989. NSW: L, 3Pe, 30°16'S 152°50'E, nr Dorrigo, Eve Ck, 9.x.1996; Pe, 3, Pe/♀, ♂, 36°36'S 149°47'E, Brown Mt, Rutherford Ck, 17.xii.1990; Pe, 35°23'S 149°55'E, Monga SF, Mongarlowe R, 2.ii.1991. ACT: Brindabellas, 2Pe, 35°20'S 148°56'E, Pierce's Ck, 24.x.1991 (Drayson); 2L, 35°21'S 148°52'E, Warks Ck, 26.iv.1988 (Calder): Le/Pe/♂, 35°22'S 148°50'E, Pe, Blundell's Ck, 14.i.1988, L, 26.iii.1988, L, 6-9.iv.1988, 2L, 13-16.iv.1988, ♂, i-ii.1988 (Colless); Le/P♂, 2L(P), 35°22'S 148°51'E, Condor Ck, 27.x.1991; L, 35°28'S 148°21'E, Tidbinbilla, Cascade Ck, 3.ii.1989. VIC: Pe, Le/Pe/♀, ♂, 36°48'S 146°51'E, Buckland R., 6.v.1991 (Cook, Cranston & Nielsen); L, P♂, 36°54'S 147°27'E, Omeo Hwy, Omeo R. 26.i.1989; L(P), 36°58'S 147°54'E, Tambo R., Currawong Ck., 11.xii.1990 (Hortle); 8L, 37°08'S 147°51'E, Tambo R., Bindi Ck, 13.iii.1989 (Hortle). TAS: 2L, 41°09'S 148°07'E, NE Tasmania, Peters Link Rd, 24.ii.1993. WA: Le/P, 34°25'S 115°47'E, Carey Brook, 23.xi.1994.

DESCRIPTION. MALE. (n=3-4) Total length 3.5mm, wing length 2.5mm.

Colour. Head pale; antennal pedicel mid-brown, plume brownish; clypeus and palps pale. Ground colour of thorax mid-yellow, median and lateral vittae brown especially at anteriorly and laterally, anterior 1/3 of pre-episternum, scutellum and mid-postnotum. Legs pale with brown ring apices of mid and hind femorae, all tibae, and tarsomere1. Wings unmarked. Abdomen uniformly yellow, hypopygium golden-brown.

Head. AR c. 1.8, terminal flagellomere conical, 3 × as long as broad, penultimate flagellomere 8 × terminal flagellomere. Eyes with dorsomedial extension 5 ommatidia until expanding to 6 at mesal end. Temporal setae 16-18, comprised of 4 postorbital continuous with linear verticals. Clypeal setae 15-21. Palp well developed, each segment longer than preceding, 3rd segment with tight cluster of 3-4 sensilla clavata located on mesal surface just distal to mid-length of segment. Scape bare, pedicel with 6-8 ventral and 2 lateral setae.

Thorax. Scutal tubercle small, distinct. Antepronotal setae 2-4; acrostichals 31-36, biserial between the vittae, diverging around scutal tubercle and ending in prescutellar field; dorsocentrals 13-22, arising anteriorly in humeral field, uniserial between vittae, becoming irregular in prescutellar field; supraalars 1-2; prealars 8-10; scutellars 16-26. Preepisternum bare.

Wing. Costa bearing uniserial row of some 100 spines of length 8-10 (Fig. 5A), running for 25-30% of anterior margin from subapex. Costa extending c. 100 beyond apex of $R_{4+5}$, ending subapically, directly above $M_{1+2}$; $R_{2+3}$ strong, running midway between $R_1$ and $R_{4+5}$; $R_3$ strong until abruptly terminating short of costa, closer to apex of $R_1$ than $R_{4+5}$. MCu slightly proximal to FCu, VR 0.86-0.90. Membrane densely setose except in radial cells, unpatterned. Anal lobe rounded. Squamal setae 24-27.

Legs. $LR_1$ 0.52-0.56, $LR_2$ 0.64, $LR_3$ 0.78; all legs quite strongly setose, with beard ratio on all legs maximally 5, lacking any tarsal brush on tarsomere 3 of mid legs. Tibial spurs as in Fig. 5B, lengths: $P_1$ 25-35, $P_2$ 35-45, 80-90, $P_3$ 35-45, 90-105; tibial comb of $P_3$ with 6 subequal setae.

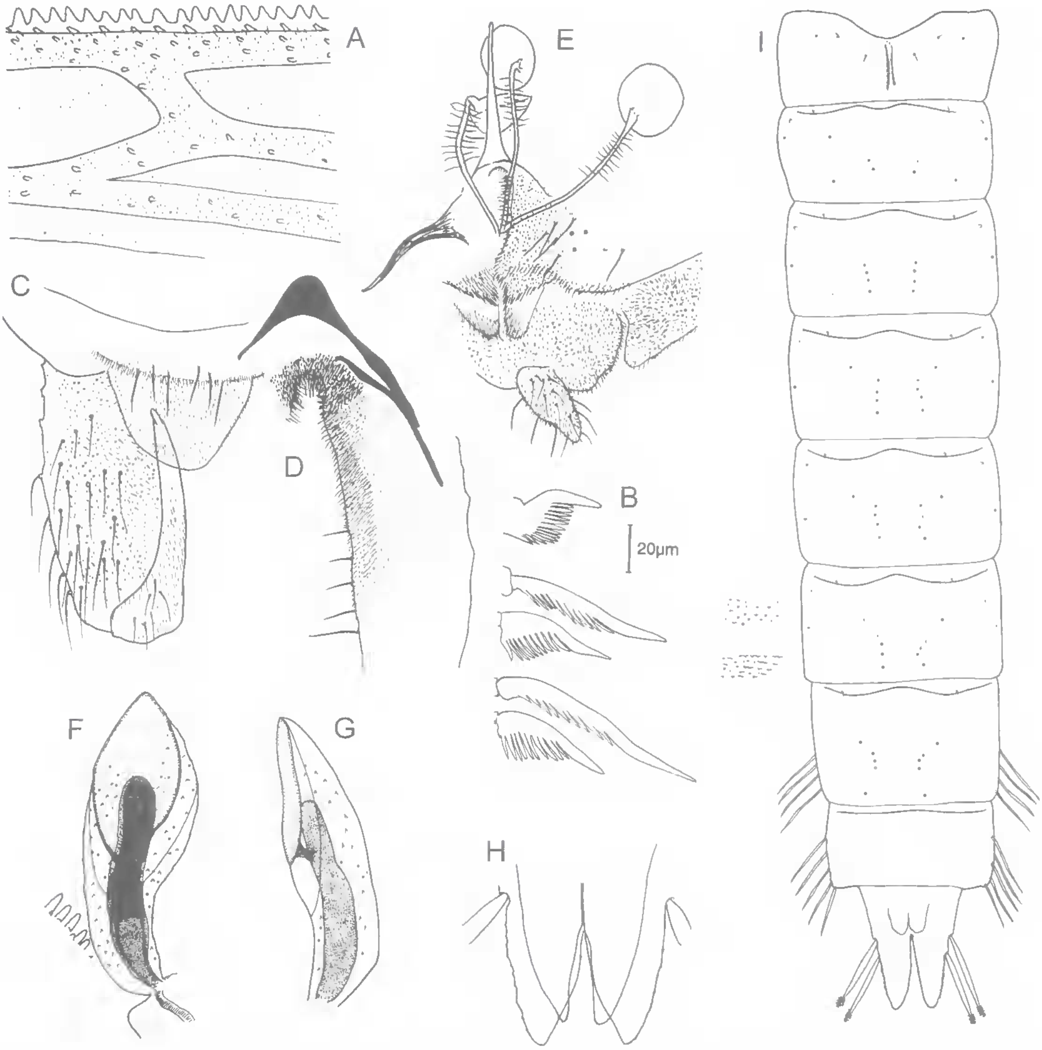


FIG. 5. *Australopelopia prionoptera* sp. nov., adult and pupa; A, anterior wing margin; B, spurs $P_1$, $P_2$, $P_3$.; C, ♂ genitalia, left side dorsal; D, right side showing base of gonostyli and volsella; E, ♀ genitalia, right side external, left side part internal; F-I, pupa: F-G, thoracic horn, F, dorsal, G, lateral; H, apex of anal lobe; I, tergites.

Claws slender, slightly curved, distally pointed, simple. Pulvilli absent.

Hypopygium. Tergite IX with an irregular median patch of 6-8 setae; 'anal point' broad and rounded, densely microtrichiose, perhaps bare apically (Fig. 5C). Gonocoxite 2.5 × as long as broad, cylindrical, densely microtrichiose mediobasally, setose with finer sparser microtrichia distally; with distinct evidence of volsella, a strongly setose slightly elevated triangular lobe beneath extended anal point (Fig. 5D). Gonostylus well developed, swollen at base, tapering in apical 2/3, terminal spur long. Phallapodeme long, sternapodeme an inverted V-shape (Fig. 5D).

FEMALE. (n=3) As male in colour and non-dimorphic features. Total length 2.5mm, wing length 2.3-2.5mm. AR 0.17-0.21, terminal flagellomere 130-175µm long, terminating in nipple. Eyes with dorsomedial extension 5-6 ommatidia wide. Temporal setae 13-14, linear uniserial. Clypeal setae 19-24. Palp as male.

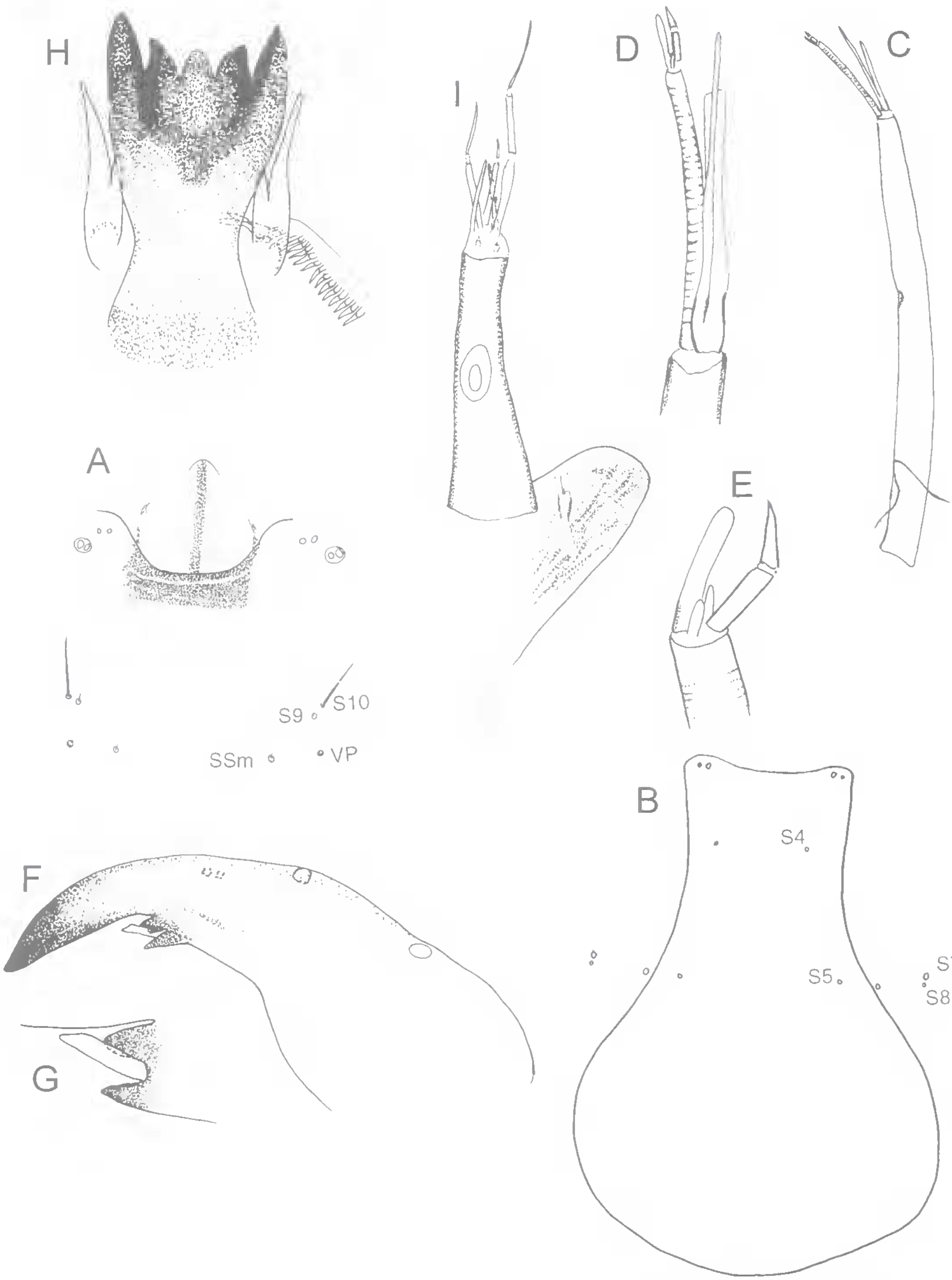


FIG. 6. *Australopelopia prionoptera* sp. nov., larva; A, mentum, submentum, ventral setae and pit; B, dorsal head, seate and dorsal pit; C, antenna; D, antennal segments 2-4; E, antennal apex; F, mandible; G, mola and seta subdentalis; H, ligula; I, maxilla.

Scape with 4 setae, pedicel with 9-13 setae forming semicircle. Antepronotal setae 3-7; acrostichals 32-38; dorsocentrals 24; supraalars 2-3; prealars 7-8; scutellars 20, biserial. $LR_1$ 0.70, $LR_2$ 0.66, $LR_3$ 0.75; Tibial spur lengths: $P_1$ 40-50, $P_2$ 45-60, 60-80, $P_3$ 40, 90-95.

Genitalia (Fig. 5E). Gonocoxapodeme VIII pale, gently curved, mesally broadened. Gonapophysis VIII triangular. Gonotergite IX without setae. Notum well developed, twice length of seminal capsule, free part of rami very pale. Tergite IX thin, non-setose. Postgenital plate large bearing small slightly pediform cerci. Three ovoid to globular seminal capsules, 70-85 long, spermathecal ducts microtrichiose, nearly straight, ending separately. Labia large, densely microtrichiose.

PUPA. (n=10) Length 4.5-5.3mm (tropical), 5.5-7.4mm (temperate), pale to golden yellow, apophyses brown, scar pale.

Cephalothorax. Thoracic horn (Fig. 5F) squashed cylindrical, narrower in lateral view (Fig. 5G), terminally tapered to broad point; 2.8-3.2 × as long as maximum width, external membrane with spines that may unite into meshwork. Hornsac tubular, occupying about half lumen at 1/3 from base, with squat connection to plastron at about 2/3 length from base. Plastron plate ovoid, occupying about 50% thoracic horn length, with narrow corona. Basal lobe modest tubercle c. 30μm long. Thoracic comb comprising 8-10 tubercles of length 25-35. Surface of thorax weakly granulate; scutal tubercle and postnotal tubercle absent. Single antepronotal seta retracted from margin, 1 weak precorneal seta; dorsal setae 1 and 2 present, simple, 2 displaced laterally to close to anterior wing sheath base, dcs4 taeniate, in supraalar position.

Abdomen (Fig. 5I). Tergite I with scar, lateral muscle marks very weak. Abdominal shagreen fine, aggregated on some segments to form rows. L setae taeniate only on segments VII (4, all clustered in posterior half) and segment VIII (all 5, more evenly spaced). D setae: 3 on I, 4 on II, 5 on III-VII, absent on VIII; $D_{2-5}$ arranged on segments III-VI in linear row. O-setae: 1 pair dorsal, 1 ventral, situated mid-curve of apophyses. Anal lobe (Fig. 5H) about 1.2 × as long as broad, bare, outer borders with spinules, inner border convex, outer border straight. Anal macrosetae at 0.5 × segment length. Gonopodial sheath of female short, of male extending c. 65% length of anal lobe.

LARVA. (n=10) Body length 5.4-6.5mm, head capsule length 640-890, golden-yellow with cephalic margin darker golden-brown to darker brown; mandible golden, tip brown, ligula golden brown basally, darker in distal half, anterior parapod claws fine and pale, posterior claws broader, simple, golden-yellow. Capsule longish-oval, cephalic index 0.7-0.75. Cephalic setation: SSm, V9 and V10 aligned at 45° to antero-ventral axis, VP posterior to V10 (Fig. 6A), dorsal pit present, S7 close to S8 (Fig. 6B).

Antenna (6C-E) half head length, segment lengths: 280-330: 65-70: 6-7: 5-6, AR: 3.6-3.7; basal segment c. 15 × as long as basal width, ring organ distal to mid-point (60%); second segment annulate (Fig. 6D). Blade bifid, broad outer branch slightly shorter than thin 75-80 inner branch. Lauterborn organs (peg sensilla, Sæther, 1980), small (c. 3); style c. 15 extending to apex of antenna.

Mandible (Fig. 6F) gently curved, with rather parallel-sided apical tooth, 130-165 long; long seta subdentalis arises between triangular accessory tooth and well developed, apically directed basal tooth, both protruding beyond inner contour of mandible (Fig. 6G). Ventro-lateral setae closely approximated outer margin, separated from sensillum minusculum by same distance as posteriormost seta 3.

Ligula (Fig. 6H) with 5 teeth, row concave, with outer teeth and middle directed anteriorly, point of inner teeth strongly curved outward; ligula strongly constricted medially; area of muscle attachment ovo-rectangular, occupying basal 17-23%, Paraligula bifid, with outer branch near half length of ligula, 2 × length of inner. Pecten hypopharyngis with 15-17 teeth, quite homogenous in size, slightly larger medially than laterally.

Maxillary palp (Fig. 6I) with strong ring organ situated in mid-segment, with well-developed crown of setae and sensilla including 3-segmented b-seta with each section subequal in length. Submentum with subapical transverse single band of lighter sclerotisation. Dorsomentum with minute traces of teeth; M appendage rounded-triangular, vesicles not distinguishable. Pseudoradula 8-11 wide, narrowed medially (i.e. slightly broader apically and basally), densely granulose without clear alignment, posteriorly without contact to any sclerotised area of ventral hypopharyngeal apodemes.

Abdomen. Body without a fringe of swim setae. Anal tubules slender, shorter than half length of posterior parapod, tapering apically, about 4× as long as basally wide. Procercus about 3× as long as wide (90-100 × 30-35), with 7 anal setae of length 450-500. Subbasal seta of posterior parapod simple. Posterior parapods with 15-16 simple short and triangular to long and narrow claws subtended by area of fine spinules on subapical parapod.

DISTRIBUTION, ECOLOGY AND BIOGEOGRAPHY. *Australopelopia prionoptera* is distributed on the eastern margin of Australia, from Cape Tribulation to northern Tasmania, predominantly in shaded streams. The single record in the Australian National Insect Collection from Western Australia is from the extreme southwest of the state from a shaded stream that harbours several other cool stenothermic taxa of gondwanan affinities. The larva, typically for the tribe Pentaneurini, is predatory with a diet that includes chironomid larva little smaller than its own length, and includes earlier instars of its own species.

As assessed by a year-long periodic interception of floating pupal exuviae, *A. prionoptera* adults, although few in number, emerged only in a narrow period of mid-summer in a southeastern subalpine stream (Willis, 1998). In contrast to the situation with *Echinocladius*, serendipitous 24 hr drift net collections suggest that this seasonality is artefactual. Final instar larvae can be found throughout winter, exuviae can be collected at almost any time of year, and larvae returned to the laboratory can pupate from within a few days to as much as several months later (Cranston pers. obs.; McKie pers. obs.). This phenomenon appears independent of feeding (usually a pupation stimulus to Tanypodinae larvae) or of temperature, and it may be that there is a partial, perhaps facultative diapause in this species.

When this taxon was thought to represent an Australian *Pentaneura*, this species was argued to represent a relictual gondwanan distribution, but the postulated phylogenetic position as sister group to a broad *Thienemannimyia*-group undermines the historical speculation. This group is almost world-wide, and its internal phylogenetic relationships are unknown: even some generic delimitation is suspect. Furthermore the Patagonian and New Zealand Tanypodinae are poorly known. However, the historico-ecological explanation of cool stenothermy mentioned under *Echinocladius* certainly appears to apply also to *Australopelopia*.

## CHIRONOMINAE

### Polypedilum Kieffer

Species of *Polypedilum* are found in virtually all aquatic habitats, and the genus is one of the largest (most speciose) in the world (Oyewo & Saether, 1998). The phylogeny is poorly understood, with first efforts by Oyewo & Sæther (1998) and Sæther & Sundal (1999) delimiting some clades, but leaving a morass of para/polyphyla, including some with subgeneric rank, notably *Pentapedilum* Kieffer. Many Australian taxa have been reared, keyed and illustrated (Cranston, 1996, 2000) but the continental biota is by no means completely understood. Amongst the fully reared taxa which are not associated with any previously described adult amongst the common species of *Polypedilum* from certain streams of the Wet Tropics. The species has been subject to experimental manipulation, and is described here to make the name available.

### Polypedilum australotropicus sp. nov.
(Figs 7,8)

*Polypedilum* FNQ1, Cranston, 2000.

MATERIAL. HOLOTYPE, Le/Pe/♂, 18°59'S 146°10'E, Queensland, Paluma, Birthday Ck, 800m, 1.x.1998, reared McKie, in ANIC. Holotype, and paratypes as follows: Queensland: 2Pe, 16°28'S 145°19'E, Mossman, nr Rex Ck, 5/6.iv.1997; 17°37'S 145°45'E, Palmerston NP, Tchooratippa Ck, 340m., 8-9.iv.1997; Pe, 17°47'.0 S 145°41'2E, Pixies Ck, 2/3.ix.1997 (McKie); Pe, 18°13'.1 S 145°48'5E, Goddard Bridge #1, 9/10.vi.1997 (McKie); Pe, 18°20'S 146°03"E, Cardwell, 5-mile Ck, 1-4.iv.1997; Pe, 18°58'.0S 146°09'8E, Camp Ck, 12/13.vi.1998 (McKie); Pe, 18°58'.7S 146°09'8 E, Mary Ck, 9.ix.1997 (McKie); Le/Pe/♀, 18°59'S 146°10'E, Paluma, Birthday Ck, 800m, 1.x.1998 (McKie); 12Pe, 25-26.iii.1998.

DESCRIPTION. Conforms in all morphology to the generic diagnoses for larva, pupa, and adult males (Wiederholm 1983, 1986, 1989) and females (Sæther 1977).

MALE. (n=1) Body length 2.7mm, pale with no darkening of vittae. Wing unmarked, length 1.2-1.3mm. Flagellomeres 1-12, 436, flagellomere 13, 375, AR 0.86. Frontal tubercles absent. Head with 9 verticals and postorbitals aligned, 11 clypeals, palp segment lengths 2-5, 35; 55; 74; 115. Thorax without antepronotals, with 9 acrostichals, 10 dorsocentrals, 3 prealars, 5 scutellars. Legs pale, unmarked, fore tarsomeres missing, mid-leg ratio 0.52, hind leg ratio 0.72; foretibial apex with rounded spur (Fig. 7A), mid-leg with narrow inner comb and broad outer comb with spur; hind leg with broad inner comb, narrower outer comb with long spur (Fig. 7B). Wing with $R_{2+3}$ running close to $R_1$, evanescent; $R_{4+5}$ gently curving, ending proximal to wing apex; setation: R 18, $R_1$ 12, $R_{4+5}$ 23, squama 5; venarum ratio 1.24.

Genitalia (Fig. 7C,D) with tergite IX bands faint, not meeting, 8 median dorsal tergal setae; posterior margin of tergite IX with 6-8 marginal setae. Anal point arising from posterior margin of tergite IX, hyaline, essentially parallel-sided to rounded apex, 35 long. Inferior volsella cylindrical, with few long setae and one strong apical seta, dorsally without microtrichia, ventrally densely microtrichiose. Superior volsella (Fig. 7D) with microtrichiose base and digitiform extension tapering to point, with outer strong seta at mid-point, where volsella contracts from broader base to digitiform apex. Gonocoxite 112; gonostylus 119, not tapered, apically rounded, without any mesal-directed setae.

FEMALE. (n=1) As for male in colour and non-dimorphic features. Body length 2.0mm, wing length 1.6mm. Flagellomeres 1-5, 105; 70; 80; 55; 145, AR 0.46. Head with 8-9 verticals and postorbitals aligned, 10 clypeals. palp segment lengths 2-5, 40; 70; 85; 150. Thorax without antepronotals, with 12 acrostichals, 12 dorsocentrals, 3 prealars, ? scutellars. LR: fore 2.27, mid 0.54, hind 0.76. Wing with $R_{2+3}$ evanescent; $R_{4+5}$ curving more strongly than in male, ending at wing apex; setation: R 17, $R_1$ 16, $R_{4+5}$ 31, squama 5; venarum ratio 1.21.

Genitalia typical for subgenus *Polypedilum*, with strong, curved gonocoxapodeme VIII, spherical seminal capsules (40-45µm diameter), without a neck, with nearly straight spermathecal ducts; with gonapophysis VIII divided into very small ventrolateral lobe, and larger dorsomesal lobe covered with linearly-aligned microtrichia (Fig. 7E).

PUPA. (n=10) Length 3.2-3.7mm, pale to mid-brown, with apophyses indistinct to brown pigmented.

Cephalothorax. Frontal tubercles absent, frontal seta 56-70. Thorax weakly creased, non-rugose. Thoracic horn (Fig. 7F) hyaline, base simple, small, circular; thoracic horn 3-4-branched, with one c. 220 long, weakly spinose branch.

Abdomen. Tergal armament as in Fig. 7G, tergite I antero-laterally with variably prominent antero-lateral projection, without sternal or tergal armament. Hook row comprising 36-51 hooks, extending 43-46% of the width of tergite II. Tergites II-VI with anterior transverse band of spines disconnected to any medial spines; II with few posterior spines, III-VI with sparse medial spine patch and essentially medially-divided posterior transverse band. Conjunctives III and IV with partially aligned multiserial rows of spines. Posterolateral corner of VIII (Fig. 7H) with small 'comb' of 3-4 basally-fused spines, one stronger than the others. Anal lobe bare, without dorsal seta, with uniserial fringe of 16-24 taeniae. Pedes spurii A on IV, weak on V, absent on VI. Pedes spurii B well-developed on II, absent on III. Taeniate lateral setae conventional for genus — 3,3,4,4 (V-VIII).

LARVA. (n=1-3) of unknown body length, head capsule length c. 420, very pale yellow, with teeth of mentum dark brown, apex of mandible and all teeth brown, occipital margin narrow, brown, labral margin golden-brown, premandible pale yellow.

Dorsal surface of head (Fig. 8A). Fronto-clypeal apotome present, anteriorly broadened, bearing S3 seta subterminally inserted, posterior to 10-12 wide hyaline area, perhaps representing the clypeal relic. Antenna (Fig. 8C) with segment lengths, 33-37, 18-20, 9, 11, 6-7; AR 0.8; Lauterborn organs narrow, 10 long; blade length 47-50. Mandible (Fig. 8D): length 105-110, with short outer tooth, two inner teeth. Mola with two spines. Labrum (Fig. 8E); SI and SII setae finely plumose, pecten epipharyngis comprises three distinctly separated scales, each with 3-4 blunt teeth. Mentum (Fig. 8F); width 77-80, with rather bulbous protruding median teeth, small 1st laterals, tall 2nd laterals and remainder decreasing in size to clustered and somewhat projecting 5th and 6th, and small but distinct 7th. Ventromental plate with c. 40 striae, width 70-77, depth 26-30, medially with medially-directed pointed apex.

Abdomen. Anterior parapod claws pale golden, simple, dense. Procercus and apical setae pale-mid brown.

REMARKS. The larva of *P. australotropicus* belongs with a group of *Polypedilum* species with an uneven mentum, 3rd antennal segment slightly greater than half the length of 4th, ventromental plate width about 2.5 × the depth, and with the median (inner) contour of the plate medially directed, with only two inner

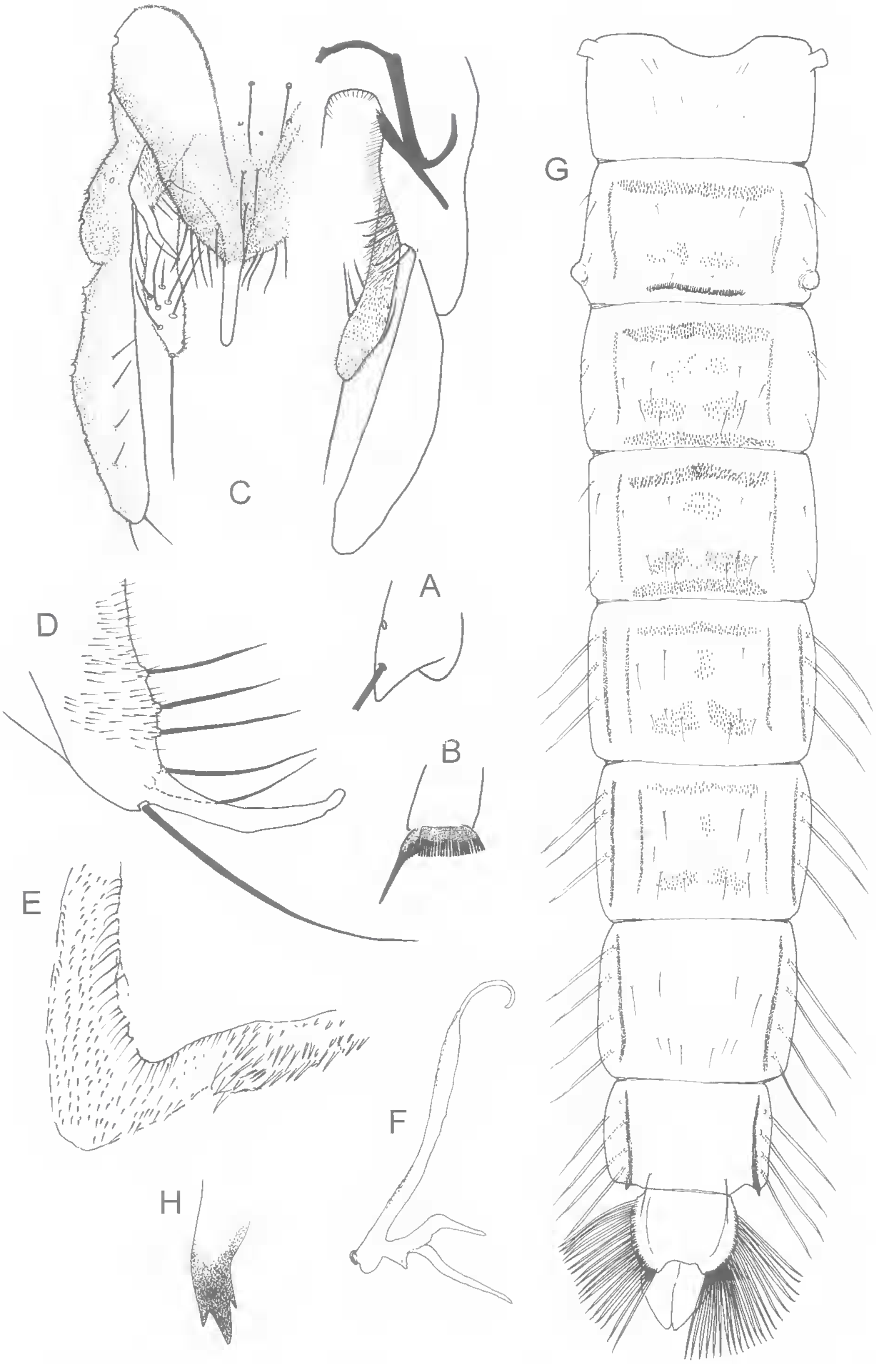


FIG. 7. *Polypedilum australotropicus* sp. nov. A-D, ♂; A, anterior tibial apex; B, posterior tibial apex; C, ♂ genitalia, left side dorsal, right side semi-internal; D, superior volsella. E, ♀, gonapophysis VIII: ventrolateral lobe, dorsomesal lobe. F-H, pupa; F, thoracic horn; G, tergites; H, posterolateral corner of VIII.

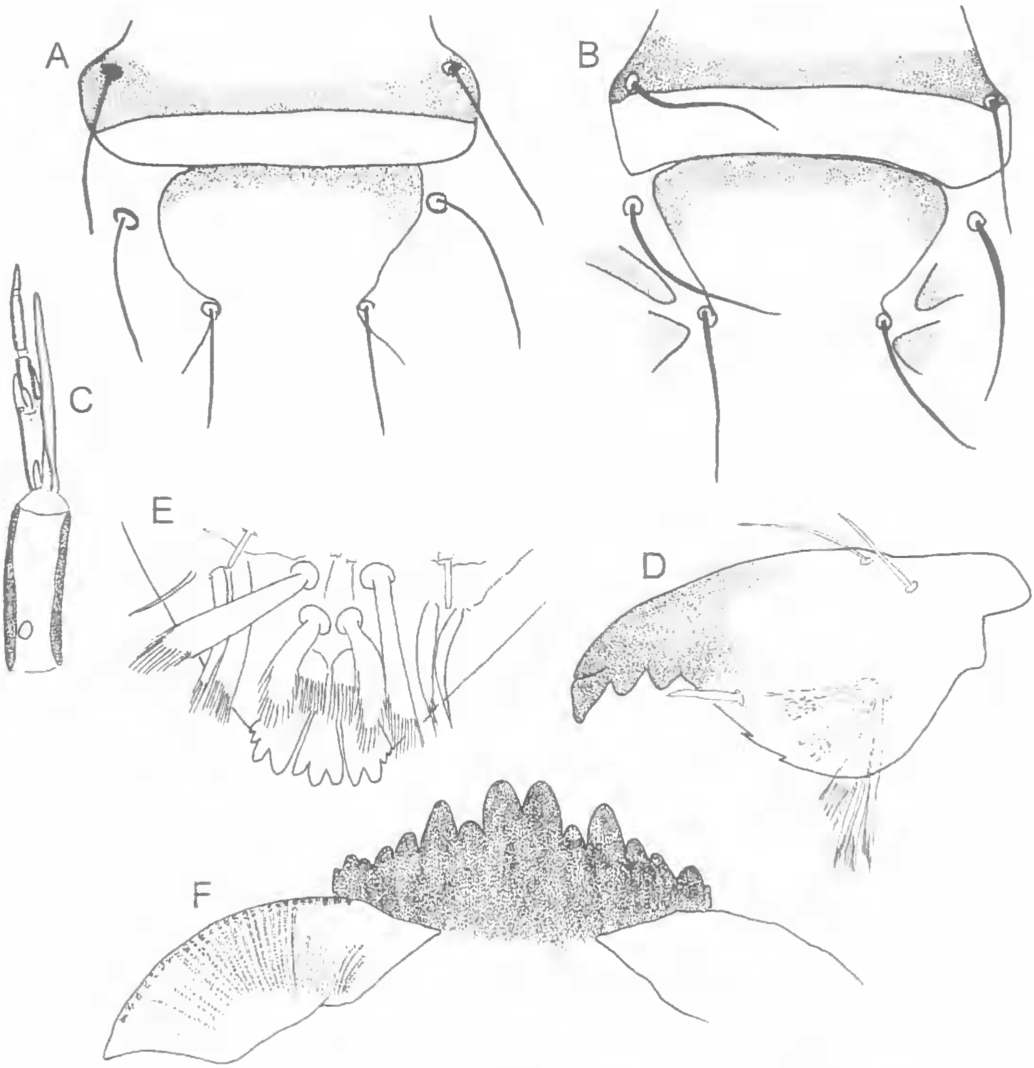


FIG. 8. *Polypedilum australotropicus* sp. nov., larva. A, anterior frontoclypeus; B, anterior frontoclypeus *Polypedilum* 'K3'; C, antenna; D, mandible; E, labrum; F, mentum and ventromental plate.

mandibular teeth and with the postoccipital margin dark. This group includes two taxa that have the median (inner) contour of the plate anteriorly directed — *P. oresitrophus* and 'M1', which are now placed in the subgenus *Uresipedilum* Oyewo & Sæther (1998). The two remaining Australian taxa with this combination of features but with the median ventromental plate contour medially-directed are undescribed and are referred to by the codes of 'K3' and 'alocasia' (Cranston, 1996, 2000). *P. seorsum* (Skuse), keyed as having a ventromental plate width: length ratio of 3 (versus 2.5) must be considered since these ratio can be as low as 2.6 and values actually overlap.

The larva of *P. australotropicus* is similar to that of *P.* 'alocasia', but the latter appears to differ significantly in ventromental plate features, with the approximately 20 striae having homogeneous width of 5μm at the anteromedian margin, in contrast to about 40 homogeneous striae of width 2μm in *P. australotropicus*. *Polypedilum* 'K3' has about 30 heterogeneous striae, with the outermost (laterad) 10 striae about 5μm wide, but with many narrower striae in the inner (mesal) half of the plate. A novel character that appears to allow separation is found on the dorsal surface of the head where the shape of the anterior frontoclypeal apotome, the breadth of the anterior hyaline band (perhaps representing the clypeus), and the position of cephalic seta S3 vary between species. In *P. australotropicus* and *P.* 'alocasia' the S3 seta is sited on a dilate anterior frontoclypeus separated from a narrow (10-12μm wide) hyaline area (Fig. 8A); expansion of the anterior frontoclypeus in 'K3' is weaker and the S3 seta is sited immediately posterior to a broader (20-25μm) hyaline section (Fig. 8B). In *P. seorsum* the hyaline anterior frontoclypeus is reduced to a very narrow strip of 2-4μm width. The elevation of the 6th lateral mental tooth with respect to the line of slope of the outer lateral teeth appears greater in *P. australotropicus* than in the other species, but interpretation of the feature is susceptible to preparation (orientation and compression) and wear.

The pupa of *P. australotropicus* belongs to a wider group that includes the two larval taxa noted above, defined by having only conjunctives III/IV and IV/V with multiserial spine bands, the anterior transverse spine band being separated from any median spine field, and having the weakly developed comb on the posterolateral corner of VIII includes a dominant spine and few subsidiary spines. The virtually bare median area of tergite II and lack of any armament on tergites VII and VIII differentiates from all species except *P. (Pentapedilum) convexum* which has a different comb comprising several subequal small spines. *P. seorsum* differs not least in the bare conjunctive III/IV. All prospective related species differ in having at least 4 lengthy non-spinose branches to the thoracic horn, unlike that of *P. australotropicus* which has a single dominant, spinose branch, and the others short.

The adult male of *P. australotropicus* has a hypopygium typical of many species of *Polypedilum* (in the strict sense, but not as represented by the type-species *P. nubifer*) with a narrow anal point and digitiform superior volsella with the microtrichiose basal section cylindrical, overlying a rounded contour of the gonocoxite with 5-6 strong setae. Similar species, including those with close resemblance in the immature stages differ as follows:

*P.* 'K3' has fore-tibial scale tapering to curved point, longer (46μm), narrower anal point, narrower cylindrical base and stouter digital part of the superior volsella, and a more tapered gonostylus.

*P.* 'alocasia' appears identical in hypopygium and foretibial scale structure, but differs in the male wing with $R_{4+5}$ strongly curved and ending at the wing apex, and with denser thoracic setosity.

*P. seorsum* (Skuse) has a very similar hypopygium, although with a somewhat more evenly tapered digitiform part of the superior volsella, and weaker basal part, and differs principally in the triangular foretibial scale.

Too few species of *Polypedilum* are described as females to understand features that vary specifically. The small ventrolateral lobe of subgenus *Cerobregma* (Sæther & Sundal, 1999) also appears common in Australian members of *Polypedilum* (s.s.).

In summary, *P. australotropicus* appears to belong in a grouping of species appropriately placed in *Polypedilum* in the most restricted sense (i.e. the Holarctic-defined *P. nubeculosum* group), which includes several species in Australia, and more from southeast Asia (Cranston pers. obs.). In this group virtually all taxonomically useful features occur in every conceivable permutation, yet with the usually informative male genitalia being very homogenous. Phylogenetic analysis appears a Stygian task beyond the scope of this contribution.

DISTRIBUTION, ECOLOGY AND BIOGEOGRAPHY. *P. australotropicus* is narrowly restricted to cool streams at elevations from sea level to 800m in Far North Queensland's Wet Tropics, from Mossman to Paluma. Here the larvae can be quite abundant in leaf packs trapped in riffle-areas (B. McKie pers. comm.). The limited pupal exuvial evidence suggests continuous emergence.

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